Introduction

While a picture may be worth a thousand words, our cover contains a thousand pictures illustrating the factors that are necessary for a child, and by extension, all of us, to be healthy. Clean air, clean water, a food chain free of contaminants, and space enough to grow and develop are essential for healthy people in a healthy world. The cover also illustrates the myriad efforts of our people conducting scientific research, working alongside health delivery partners, and sharing interventions at a community level so that children, their parents, and their grandparents can live healthier lives–both in the United States and wherever collaboration with our global partners allows us to be effective.

The pages that follow summarize highlights from our activities during the past year, as well as our plans for the future. We at the National Center for Environmental Health are enthusiastic about the vision for all of the Centers for Disease Control and Prevention (CDC) that has been articulated by the CDC Director, Dr. Jeff Koplan. We believe that our work in environmental health and human development (a component that we've proposed incorporating in our Center's name to emphasize our work in genetics and child development and in enhancing the lives of people with disabilities) will help make this vision a reality.

One area that we are concentrating on is enlisting partners to help translate scientific knowledge into effective public health action. For example, although we know that folic acid can prevent neural tube defects, it is only through collaboration with numerous partners that we can effectively deliver this message to all American women of reproductive age. NCEH's Vessel Sanitation Program is an example of how a partnership with industry can dramatically improve people's health, in this case by reducing the incidence of disease aboard cruise ships. By establishing similar partnerships with the food and restaurant industries, we should be able to cut the rate of food-related illness in half over the next 10 years. In collaboration with partners inside and outside the health sector, we also plan to refocus on the long-neglected area of environmental sanitation, which was once a backbone of public health.

Our Center will also focus on responding to the environmental injustice that affects poor people and people of color in our society in numerous ways. All too many children in the United States live in substandard and dangerous housing units that are poorly heated, lead- and cockroach-infested, and literally fire traps. A disproportionate number of these children are minorities. We at CDC need to work with housing agencies, planners, and financiers to improve this fundamental cause of poor health. Lead poisoning will ultimately be eliminated, not by doctors, but by those who invest in and rebuild community infrastructure.

Highway pavers and building inspectors need to know that they, too, can do something that directly impacts children's health. A focus on these issues will go far in eliminating current racial disparities in health in the United States. And to determine the effectiveness of our intervention efforts, we will need to use health measures such as blood lead levels and death rates from asthma. This kind of measurable accountability can overcome public skepticism about the government's ability to improve the health of its citizens, especially those most in need.

A third area that we are focusing on is genetics. As information about all 100,000 human genes becomes available during the next 5-8 years, the public health system is in danger of being overwhelmed by the flood of new information and the ethical, legal, and social challenges that this information will provoke. CDC's strategic plan for genetics and disease prevention lays the foundation for translating genetic breakthroughs into effective public health actions to be carried out through partnerships with states, academia, other federal agencies, and the private sector.

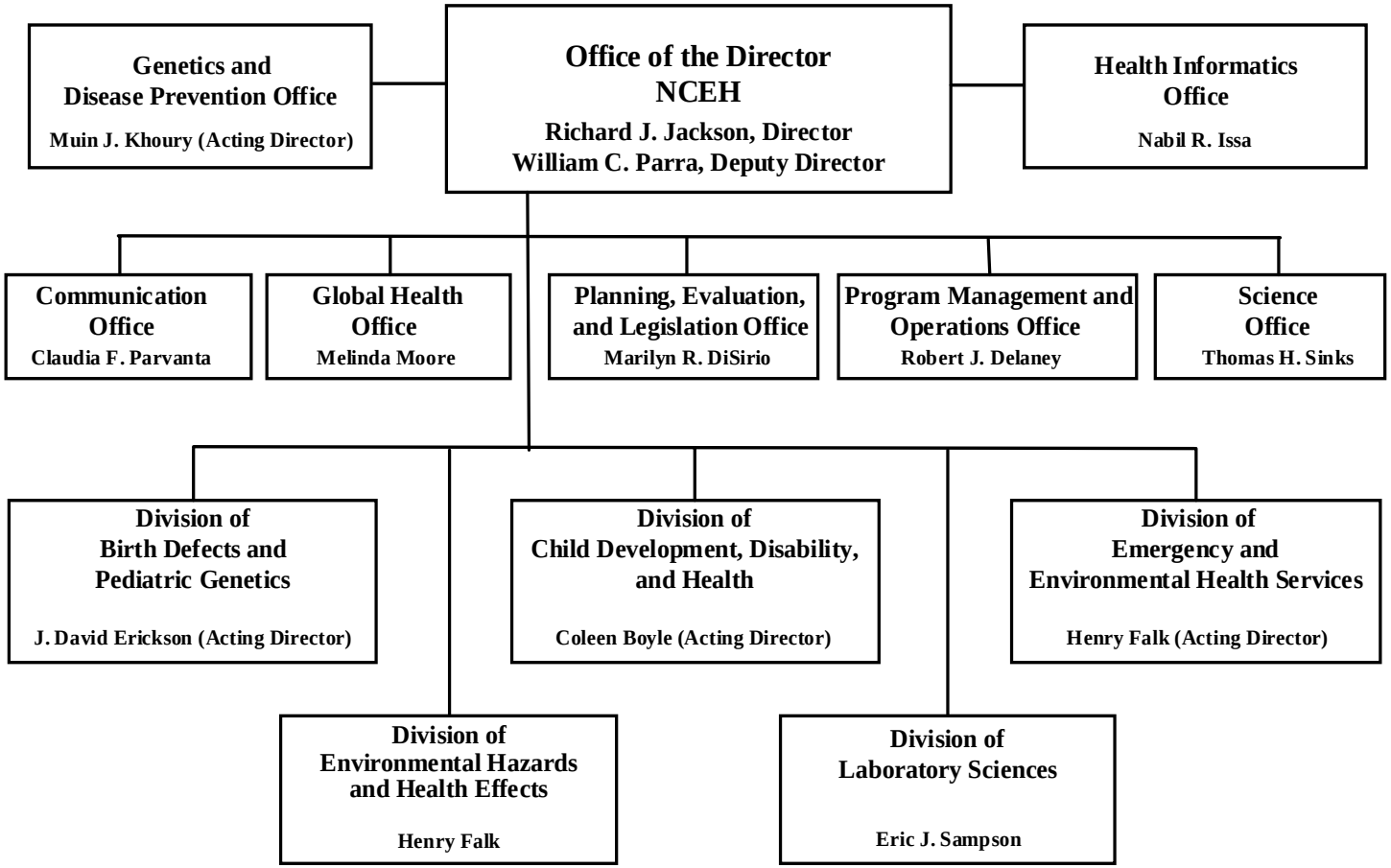
Finally, I would like to mention two internal activities at NCEH that will determine how our Center functions. In 1999, we revised our strategic plan to guide our decisions about resource allocation, articulate future program needs, and measure our performances as required by the Government Performance and Results Act.

Similarly, we've taken concrete steps to increase workforce diversity over 1998 levels. We have created a plan for hiring, recruiting, retaining, promoting, and fostering the career development of culturally diverse employees. Their various backgrounds, perspectives, and skills will improve our effectiveness in responding to the diverse needs of increasingly diverse communities, both locally and globally.

I'm proud of the people and our work at NCEH. The following pages tell a story of many different people working on many different problems who all contribute to making the world a healthier place to live. This synergy of effort gives CDC its ability to be the nation's resource for environmental public health.

Richard J. Jackson, M.D., M.P.H.
Director, NCEH

National Center for Environmental Health*

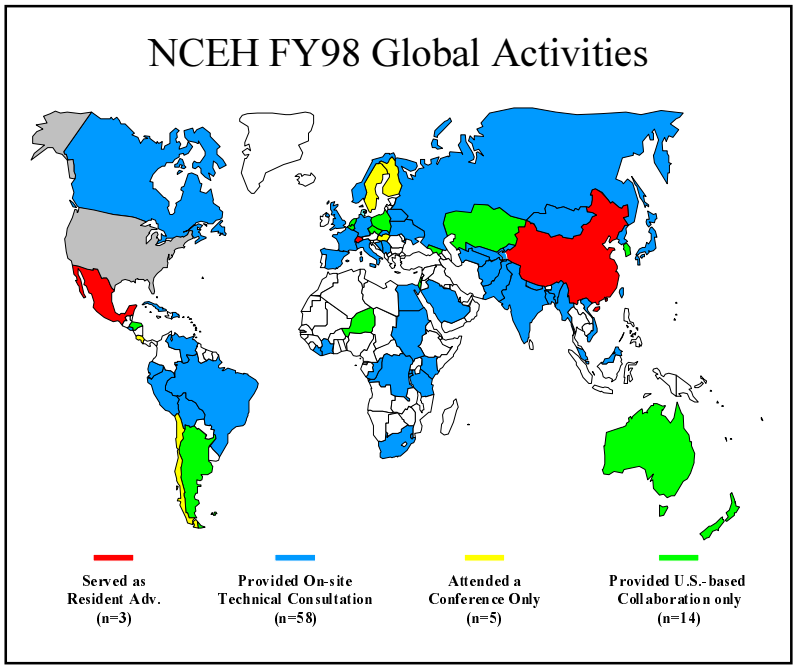


*Proposed Reorganization

NCEH Global Health Activities

Introduction

During 1998, NCEH developed a strategic agenda that is based on global health problems, CDC's public health niche, and NCEH's strengths. We identified five main global priority areas, which are described in further detail below: (1) childhood lead poisoning; (2) water, sanitation, and hygiene; (3) urban health and megacities; (4) micronutrient malnutrition; and (5) emergency preparedness and response. In addition, we are also concerned about the health effects of exposure to pesticides and radiation, the etiology and prevention of birth defects, genetics and disease prevention, child development, and disabilities (including those caused by landmines).



During FY 1998, NCEH collaborated with 77 countries (63 on-site and 14 through U.S.-based consultations). Global activities accounted for 6% of total NCEH staff time.

NCEH collaborates with other CDC centers and a number of key external partners, including U.N. agencies, other U.S. governmental agencies, nongovernmental organizations, academic institutions, foundations, and professional organizations. We are also developing a plan to evaluate the success of NCEH global activities based on five types of possible impact: (1) direct impact (the effects of NCEH's own field work); (2) leveraging impact (NCEH's influence on resource allocation and technical programming by partner agencies and countries); (3) emulation impact (the extent to which other countries model their own programs after NCEH programs); (4) enabling impact (the effect of training and capacity development); and (5) domestic impact (the application of lessons learned overseas to address U.S. public health problems).

NCEH'S Global Priorities

Childhood Lead Poisoning. The vast reduction in the number of cases of childhood lead poisoning in the United States has been a triumph of environmental public health. We believe that this success can be shared with other countries. CDC, which has been a leader in the U.S. success, can play an important role in mobilizing global lead poisoning prevention efforts.

We can help assess the scope of childhood lead poisoning in major regions of the world and identify feasible intervention opportunities, develop and use new technologies for lead screening in developing countries, build a coalition of key partners, and build the base for more systematic global lead poisoning prevention efforts.

During FY 1998, NCEH completed assessment studies of blood lead levels of people in U.S.-Mexico border cities, in Russia, and in one district of Cairo, Egypt, and planned studies for India and other Middle East areas. We also initiated a global literature review and established a database that includes nearly 1,000 published articles from approximately 60 countries worldwide. During FY 1999, we will publish a written summary of the review and provide a searchable database on the NCEH Web site. In February 1999, NCEH, in conjunction with the George Foundation, the World Bank, and the Environmental Protection Agency (EPA), will co-sponsor a major workshop on childhood lead poisoning in Bangalore, India.

Water, sanitation, and hygiene. Inadequate water and poor sanitation and hygiene collectively represent the leading environmental contributor to global disease burden. Our approach to this problem is to identify global water supply and sanitation needs, assess NCEH capabilities and comparative strengths, identify partner institutions, and establish collaborative activities. An early priority is to address environmental antecedents of infectious diseases by working closely with NCID. In addition, NCEH's Vessel Sanitation Program (VSP) monitors the sanitation practices of cruise ships that pass through U.S. ports and also collaborates, upon request, with foreign countries to inspect ships under construction.

During FY 1998, NCEH planned studies of water quality and diarrheal disease along the U.S.-Mexico border. During FY 1999, we will begin these studies and also begin activities with newer global partners such as the Thrasher Research Fund and Mexico's National Institute of Public Health. In addition, the VSP will provide consultation to Australia in connection with the 2000 Olympics.

Urban health and megacities. Rapid, unplanned urbanization has created unhealthy environments and increased the burden of disease caused by polluted air and water, poor sanitation, and urban crowding. This burden varies substantially, both among and within cities. During FY 1998, NCEH completed an initial assessment of global urbanization and urban environmental health issues and explored feasible collaborative activities with potential partners. During FY 1999, we will publish a monograph from this initial assessment, which we hope will help guide the emerging global urban environmental health agenda. We will continue to collect and analyze secondary urban data and will initiate new field activities and primary data collection (e.g., in Mexico and India).

Micronutrient malnutrition. Micronutrient malnutrition (MM) affects approximately one-third of the world's population and disproportionately affects children and women. This is especially tragic because simple cost-effective interventions are available. During FY 1998, NCEH helped organize a CDC-wide working group to think about an agency strategy and activities related to MM. We also completed analyses of data from a large community intervention program to prevent neural tube defects by providing reproductive-age women with folic acid supplements (China, 1993-1996). During FY 1999, NCEH hopes to contribute to the development of a CDC-wide global MM initiative. Building upon our strong collaboration with China, we will explore the feasibility of a clinical trial of folic acid to prevent congenital heart defects.

Emergency preparedness and response. NCEH assists in emergencies throughout the world by providing technical assistance to strategic partners, by helping to expand the capacity of both CDC and external partners to respond to emergencies, and by conducting strategic research to help improve emergency preparedness and response. We must prepare for and respond to natural and technological disasters, complex humanitarian emergencies, and now the threat of bioterrorism.

During FY 1998, NCEH conducted a needs assessment of displaced populations following the May 1998 earthquake in Aiquile, Bolivia; conducted workshops related to the El Niño weather phenomenon in Ecuador, Venezuela, and Bolivia; taught courses on epidemiologic methods for use in the aftermath of disasters in Mexico and Costa Rica; conducted earthquake preparedness training in Nepal; and developed a study of health effects from smoke and haze associated with widespread forest fires in southeast Asia. We also studied the treatment of severe anemia among refugees in Tanzania and conducted health assessments or follow-up studies of complex humanitarian emergencies in Afghanistan, Republic of Congo, North Korea, Vietnam, Sudan, Kosovo, Rwanda, Burundi, and Liberia.

Our plans for FY 1999 include responding to emergencies as needed, providing training, and conducting research. In addition, as described in the section on the NCEH laboratory, we will begin developing a Rapid Toxic Screen to detect and measure 150 toxic substances in 50 people in 48 hours. When perfected, this screening technique will be an important tool for responding to an act of bioterrorism.

Domestic Impact of Global Activities

NCEH's international activities benefit the populations of countries where we work, and they also ultimately benefit U.S. citizens. Following are some examples of potential or real domestic impact from our FY 1998 activities, in each of five categories.

1. Protect Americans at home and abroad. Certain environmental problems may not be contained within international boundaries. NCEH's efforts to help rapidly detect these problems in other countries and to intervene against them may limit their spread and impact in the United States (e.g., VSP's investigations of gastroenteritis aboard international cruise vessels).

2. Improve our understanding of priority public health problems. Information about health problems in other countries can often be applied in the United States. For example, the results of the joint U.S.-China folic acid study mentioned above will help justify interventions for U.S. populations.

3. Develop new strategies, approaches, interventions. Strategies developed and tested overseas may be applicable in the United States. For example, NCEH recently learned

that the Netherlands has rapidly increased the percentage of reproductive-age women who take folic acid supplements to prevent neural tube defects. NCEH will assess factors contributing to this success and help apply them to birth defects prevention in this country.

4. Develop and refine methods. International settings can be conducive to the development and testing of new laboratory and field survey methods relevant to domestic public health. For example, a new portable blood lead analyzer developed in the United States is being field tested through NCEH collaborations in Russia, India, and Mexico. The results of these tests will be useful to U.S. state and local health departments that will have to decide whether and how best to use these analyzers. In addition, NCEH collaboration in international studies of micronutrient malnutrition will allow researchers to define, validate, and apply laboratory-based nutritional assessment techniques that may prove useful in U.S.-based surveys, such as the National Health and Nutrition Examination Survey (NHANES).

5. Standardize measurements globally. International collaborations lead to improved global standardization of laboratory tests, research methods, and policies; such standardization allows for more valid comparisons across countries worldwide. NCEH is a global reference laboratory for the standardization of blood lipid measurements.

Through its many international activities, CDC plays an important role in improving global health. In an increasingly interdependent world, most of these activities will also provide collateral health benefits for U.S. citizens.

For further information, contact Dr. Melinda Moore, Director, Global Health Office, National Center for Environmental Health, CDC, Mail Stop F29, 4770 Buford Highway, NE, Atlanta, GA 30341-03724, or visit the NCEH Web site (www.cdc.gov/nceh).

Division of Birth Defects and Pediatric Genetics*

Early last year, Congress passed the Birth Defects Prevention Act of 1998, which became Public Law 105-168. This bill authorized CDC to (1) collect, analyze, and make available data on birth defects; (2) operate regional centers for applied epidemiologic research on the prevention of birth defects; and (3) inform and educate the public about the prevention of birth defects. NCEH activities in each of these areas were significantly strengthened in 1998, and the proposed new Division of Birth Defects and Pediatric Genetics was charged with carrying out the mandates of the Act. The following describes proposed activities of the new division.

Birth Defects Surveillance

U.S. surveillance. During 1998, NCEH awarded 3-year cooperative agreements to 18 states to address major problems that hinder the surveillance of birth defects and the use of data for prevention and intervention programs. These problems include variability in the effectiveness of state surveillance programs, lack of effective program support by states, and collected data not being used for planning, prevention, and evaluation. The states received funding for three categories of activities: to initiate new surveillance programs where none now exist (Maine, Montana, Nevada, and New Hampshire); to support new programs (Florida, Kentucky, Missouri, New Mexico, North Carolina, South Carolina, and Utah); and to improve existing surveillance programs (Arkansas, Colorado, Hawaii, Iowa, Michigan, New York, and Oklahoma).

Chinese study of the effectiveness of folic acid in a community intervention. During 1998, we finished analyzing the data from a study conducted jointly with Chinese health officials to determine folic acid's effectiveness in reducing rates of neural tube defects (NTDs) in two areas of China. In summary, this study showed that in northern China, which has a high incidence of NTDs, women who took 400 µg of folic acid daily at least 80% of the time before and in the early stages of pregnancy reduced

**Proposed name*

their risk of having an NTD-affected pregnancy by 85%. Among participating women in southern China, where the incidence was lower (similar to the U.S. NTD rate), the reduction in risk was 40%.

Centers for Birth Defects Research and Prevention

Birth defects are the leading cause of infant mortality in the United States, accounting for more than 20% of all infant deaths. Of about 120,000 U.S. babies born each year with a birth defect, 8,000 die during their first year of life. In addition, birth defects are the fifth-leading cause of years of potential life lost and contribute substantially to childhood morbidity and long-term disability. Because the causes of about 75% of all birth defects are unknown, the public continues to be anxious about whether environmental pollutants cause birth defects, developmental disabilities, or other adverse reproductive outcomes. The public also has many questions about whether various occupational hazards, dietary factors, medications, and personal behaviors cause or contribute to birth defects.

To help answer these questions, in 1996, Congress directed CDC to establish Centers of Excellence for Birth Defects Prevention Research. In 1996, we gave the first cooperative agreement awards of $500,000 per year for 5 years to organizations in California and Iowa. We have since increased the awards to $800,000 per year and granted similar cooperative agreement awards to organizations in Arkansas, Massachusetts, New Jersey, New York, and Texas. The centers established in these states will expand and improve existing surveillance, for example, by integrating prenatal diagnoses into surveillance activities. They will also develop, implement, and evaluate local studies in the following categories: the effectiveness of various methods for the primary prevention of birth defects, the teratogenicity of various drugs, the environmental causes of birth defects, genetic factors that make people susceptible to environmental causes of birth defects, the behavioral causes of birth defects, and the costs of birth defects.

National Birth Defects Prevention Study. The largest activity for the seven centers will be their participation in the National Birth Defects Prevention Study, a case-control study of infants born with major congenital anomalies. The study involves an interview with the mother of study infants and the collection of biological specimens (via cheek swabs) from the infants and their mothers and fathers. Each center will enroll least 300 case and 100 control infants each year, making this study the largest case-control study of birth defects ever undertaken. Our Birth Defects and Genetic Diseases Branch, which has been conducting a similar risk-factor study since 1993, will also participate. CDC will pool the data and make them available to all collaborating researchers.

Folic Acid National Education Campaign

In 1997, CDC formed a coalition of organizations that were interested in promoting the consumption of the vitamin folic acid for the prevention of birth defects. This coalition, now known as the National Council on Folic Acid (NCFA), initiated the Folic Acid National Education Campaign to educate women of reproductive age and their health care providers about the need for reproductive-age women to consume 400 mcg of folic acid in order to reduce their risk of having a child with spina bifida or anencephaly. CDC has contributed to this effort by using extensive health communications research to develop and test targeted messages and materials for English- and Spanish-speaking audiences. We will provide the materials and an implementation plan to all partners who wish to participate in a national campaign that will begin in May 1999. Our partners will be able to reprint any materials using their own logo and name, although CDC and the NCFA will coordinate national mass media messages.

The campaign will target all women of reproductive age, health care professionals who serve them, and community advocacy groups. Women will be approached as two audience segments: those planning a pregnancy (termed pregnancy "contemplators") and those not planning a pregnancy (termed pregnancy "noncontemplators").

Contemplators. The pregnancy contemplators, who generally fall in the 18- to 35-year-old age range, are defined as women who are planning a pregnancy within the next year or so. They would seriously consider a behavioral change if it would improve their chances of giving birth to a healthy child. Although many of these women have heard of folic acid, most think that they need to take it only after they learn that they are pregnant. Therefore, the health messages directed to these women will emphasize the importance of taking folic acid prior to conception and during the first few months of pregnancy. An important subset of the contemplator group is Hispanic women, who have higher rates of NTD-affected pregnancies and lower overall awareness of the benefits of folic acid than the general population. Our research has shown, however, that unlike women in the general population, most Hispanic women acknowledge the possibility of becoming pregnant even if they are not actively planning to do so. Therefore, a concurrent campaign for Hispanic women will use materials developed especially for that group and employ the strategy used to reach contemplators.

Noncontemplators. The pregnancy noncontemplators are harder to reach. These women are usually 18-24, are not planning to become pregnant, and are resistant to behavioral change. Only 26% of these young women are currently taking a multivitamin. They do not see the relevance of doing so for themselves, and they believe that anything related to pregnancy does not apply to them. To reach this group of young women, we will use messages with a "hip," youthful, energetic tone that will emphasize that their bodies are ready for pregnancy even if they are not planning to become pregnant now.

In October 1998, NCEH published the *Folic Acid Resource Guide*, a user-friendly source of information to help our partners, local organizations, health departments, and community members conduct local folic acid education campaigns that will complement the national effort. This resource guide is available to all who request it. "Flo," pictured here, is the "spokes-character" for the guide.

On January 28-29, 1999, CDC, the March of Dimes, and the National Council on Folic Acid held a national conference to motivate partners, share resources, and provide technical training. About 600 people attended. The leaders of the conference, including those from CDC, were invited to the White House to brief the First Lady about the planned folic acid campaign, which will begin on Mother's Day 1999. Information about the conference and campaign activities can be found at www.cdc.gov/nceh/prevent/Flo.

For further information, contact Dr. Dave Erickson, Acting Director, Division of Birth Defects and Pediatric Genetics, National Center for Environmental Health, CDC, Mail Stop F45, 4770 Buford Highway, NE, Atlanta, GA 30341-03724, or visit the NCEH Web site (www.cdc.gov/nceh).

Division of Child Development, Disability, and Health*

NCEH seeks to promote optimal fetal, infant, and child development; prevent childhood developmental disabilities; and enhance the quality of life and prevent secondary conditions among children, adolescents, and adults who are living with a disability. To accomplish this mission, the proposed Division of Child Development, Disability, and Health (DCDDH) monitors the annual prevalence of each of five serious developmental disabilities among children, conducts epidemiologic studies to identify preventable risk factors, evaluates the efficacy of interventions for optimal child development, and tracks the prevalence of adult and child disability on a state and national basis.

Surveillance-Related Activities

Since 1991, NCEH has conducted the Metropolitan Atlanta Developmental Disabilities Surveillance Program (MADDSP), an ongoing collection of data on five developmental disabilities in the metro-Atlanta area: cerebral palsy, mental retardation, autism, and hearing and vision impairment.

**Proposed name*

In addition to showing the prevalence rates for these disabilities and any changes in these rates over time, data from the MADDSP are often used by division researchers and others in studies to identify risk factors for developmental disabilities.

During 1998, we used MADDSP data in several studies, the findings of which have important implications for the prevention of developmental disabilities. For example, we completed a study confirming previous reports that intrapartum exposure to magnesium sulfate reduced the risk for cerebral palsy among babies weighing less than 4 pounds at birth; we found that among 3- to 10-year-old children, retinopathy associated with premature birth was the most frequently reported cause of serious vision impairment and that as many as 19% of all cases of serious hearing impairment were associated with a birth weight of less than 5 1/2 pounds. And by analyzing reported underlying causes of mental retardation, we showed that many cases of mental retardation are preventable, such as those associated with fetal alcohol syndrome, spina bifida, congenital infections, and postnatal head trauma.

To supplement MADDSP, we also initiated a new form of surveillance for cerebral palsy, in which affected children are identified as soon as possible after their condition is diagnosed (as early as 6 months of age) through a review of medical records at a wide array of pediatric facilities in the metro-Atlanta area. This effort paved the way for studies of the causes of cerebral palsy.

Division scientists also worked with the Council of State and Territorial Epidemiologists to develop standard surveillance case definitions for specific developmental disabilities and consulted with Chinese medical researchers on issues related to surveillance and etiologic studies of cerebral palsy. And, as a result of our pilot study in metro-Atlanta to determine whether existing records at schools and other sources could provide the basis for accurate autism surveillance, NCEH was invited to participate with the Agency for Toxic Substances and Disease Registry ATSDR in a project in Brick Township, New Jersey, to assess whether the prevalence of autism there is unusually high. A Division staff member has been working on site in Brick conducting comprehensive psychological assessments of children suspected of having the condition.

In an effort to gather more uniform national data on disabilities, we funded and helped develop disability-related questions for use in CDC's ongoing Behavioral Risk Factor Surveillance System (BRFSS), a state-based survey of the adult population. The disability component of the BRFSS is now used in 16 state survey programs. Partial-year data from 10 states are currently being analyzed, and the first report on the responses to the disability-related questions will be published in June 1999.

Collaborative Projects

CDC Parenting Research Projects. Because of the importance of the first 5 years in a child's life, we launched the "CDC Parenting Research Projects" by funding studies of two interventions designed to influence parenting behavior. The studies, to be conducted at two leading universities, will target low-income families. The intervention programs will emphasize parental responsibility, parent-child interaction, and parental guidance of children's socialization and language and cognitive development. Researchers will use a randomized controlled study design to assess the extent to which the program has short- and long-term effects on parenting behavior, family functioning, and child development.

Regional Centers for Excellence. To supplement MADDSP data, which are drawn from a single area of the country (Atlanta), NCEH has proposed establishing up to five "Regional Centers of Excellence for the Prevention of Neurologic Developmental Disabilities." These proposed centers would develop surveillance programs for developmental disabilities, initially focusing on cerebral palsy, autism, and mental retardation; develop and implement regional studies of possible causes of developmental disabilities; and explore the feasibility of establishing registries of biologic specimens from selected groups of pregnant women routinely screened for other purposes that can later be linked with the centers' surveillance programs. These proposed centers would also participate in the National Collaborative Developmental Disabilities Project, a case-control study of children with specific developmental disabilities.

State-based FAS surveillance. In 1998, we initiated a cooperative agreement program with five state health departments to design and implement fetal alcohol syndrome (FAS) surveillance using multiple data sources (rather than the traditional one-source method) and including children identified in early childhood (rather than just those identified as newborns). The health departments will identify sources of information on FAS cases, abstract that information, and then track it in an electronic data system. The information will be used to determine the magnitude of the FAS problem and to see how it varies in different populations. This effort is the first step in developing a useful method for evaluating the effectiveness of prevention efforts.

Project Choices. During the past year, we have focused on developing behavioral interventions directed toward women at greatest risk for an alcohol-exposed pregnancy. To test these interventions, the division funded "Project Choices," targeted at various groups of women at high risk for an alcohol-exposed pregnancy. Groups to be studied at three different sites include female jail inmates who are about to be released, women at an alcohol treatment facility, women at several primary care settings, and high-risk women recruited through the media.

Disability-related projects. During 1998, we led an effort to develop a new chapter for inclusion in the upcoming Public Health Service publication, *Healthy People 2010*, which will address the health of people with disabilities. The inclusion of this chapter will help raise the visibility of health issues of concern to the 54 million Americans with disabilities. We also funded a cooperative agreement with the World Health Organization to field test protocols for the new revision of the *International Classification of Impairments, Disabilities, and Handicaps (ICIDH-2)*, with special emphasis on the new environmental component of the classification system. In addition, we sponsored the National Conference on Disability and Health, which provided a forum for national leaders in the field to share information on recent advances in health promotion and the prevention of secondary conditions among people with disabilities, as well as to discuss associated scientific and public health issues.

Through these and other activities, NCEH's proposed Division of Child Development, Disability, and Health will continue using the tools of public health prevention research to promote child development, prevent developmental disabilities, and promote health and prevent secondary conditions among people who have a disability.

For further information, contact Dr. Coleen Boyle, Acting Director, Division of Child Development, Disability, and Health, National Center for Environmental Health, CDC, Mail Stop F15, 4770 Buford Highway, NE, Atlanta, GA, or visit the NCEH Web site (www.cdc.gov/nceh).

Division of Emergency and Environmental Health Services*

The proposed NCEH Division of Emergency and Environmental Health Services (EEHS) includes seven major activities: refugee health, emergency preparedness and response, environmental health services, chemical demilitarization, vessel sanitation, national parks environmental health, and pharmaceutical stockpile management (in preparation for possible acts of chemical and biological terrorism). These seemingly disparate activities have the common purpose of interacting with other parts of CDC to provide national and international leadership in coordinating, delivering, and evaluating emergency and environmental health services. EEHS will coordinate the CDC-wide response to environmental disasters, play a key role in combating the emerging challenge of terrorism, oversee the destruction of U.S. chemical weapons and stockpiled chemical agents, and lead the CDC response to international refugee emergencies. In addition, the division will provide technical assistance to state and local health departments and help ensure the safety of water and sanitary conditions throughout the U.S. National Park System and aboard cruise ships that dock in U.S. ports.

**Proposed name*

Refugee Health

During 1998, the division's International Emergency and Refugee Health Branch responded to the complex humanitarian and public health needs created by emergencies around the world, from famine in North Korea and Sudan to mass population displacements in Kosovo and central Africa. In responding to these needs, we collaborated with the U.S. Office of Foreign Disaster Assistance, U.N. agencies, and nongovernmental organizations, as well as with the host governments.

In addition to these immediate responses, we also began operational research projects to address ongoing public health issues common to refugee situations. For example, in response to large increases in the rate of deaths associated with anemia among Burundian refugee children in western Tanzania, we conducted a randomized, double-blind clinical trial for treating severe anemia. By the end of the 3-month trial, we were able to recommend a safe, effective therapeutic approach for

treating refugee children with moderate and severe anemia. These recommendations have since been implemented; during 1999, we plan to return to Tanzania to evaluate the continued effectiveness of the approach through a serological survey. Projects such as this, which relied on collaboration from CARE, the Tanzanian Ministry of Health, and elements of three different centers within CDC, including NCEH's NHANES laboratory, make optimum use of CDC's strengths in addressing global health needs and are crucial NCEH priorities.

During 1999, we also plan to further expand our operational research activities by conducting an intervention trial to determine how much soap is needed in refugee camps in order to prevent diarrhea, to test new techniques for health surveillance and population estimation, and to produce guidelines for rapid assessment of water and sanitation needs in humanitarian emergencies.

Emergency Preparedness and Response

Our Emergency Preparedness and Response Branch (EPRB) tackles the even more unpredictable public health emergencies created by natural or technologic causes or terrorism. The EPRB coordinates and directs CDC-designated activities under the Federal Emergency Response Plan and also maintains a 24-hour support system for response to disasters not covered by the federal plan.

For example, when Hurricane Georges hit the Dominican Republic and Puerto Rico, we coordinated CDC activities, which included establishing emergency disease surveillance and environmental assessment for water quality and vector control. These initial assessments helped to identify immediate public health priorities and led to further epidemiological surveys by NCEH's Health Studies Branch during the post-emergency phase of the disaster.

During FY1999, we will focus on preparing for and responding to terrorism, including the use of nuclear, biological, and chemical agents. We will also coordinate training for state and local health department staffers and health-care providers and facilitate the development and implementation of state-specific plans to sustain public health operations following a terrorist incident.

Environmental Health Services Activity

The Environmental Health Services Branch attempts to identify environmental causes of disease and translate that information into a form that is useful to local environmental

health practitioners. A survey of 3000 local U.S. health departments showed that more than 75% were required to regulate restaurants, sewage disposal systems, and private water supplies. However, because of the decreased emphasis on local problems by the federal government, insufficient formal accredited training, and the abolishment of CDC training in environmental health, the personnel in these departments are often not qualified to deal either with the ongoing demands of these key public health activities or with potential new or re-emerging threats.

To respond to these identified needs, EEHS plans to create, by 2003, an Environmental Health Service Corps that would support state and local environmental health services. Within the next year, the Environmental Health Services Branch will work on the following activities:

1. Assemble a staff with the technical expertise to respond to the needs of local and state environmental public health concerns and be a resource within CDC.

2. Work with CDC's National Center for Infectious Diseases (NCID) on food-borne illness investigations to identify environmental factors associated with illnesses and translate that information for use by local practitioners. Also identify the educational needs of local environmental health practitioners and develop appropriate training for them in the areas of food protection, surveillance, and environmental components of food-borne illnesses.

3. Develop reference material for use by local environmental health professionals, including Web site manuals on rodent control and swimming pool inspection.

4. Help prepare environmental health professionals by working with accredited programs of environmental health at the undergraduate level and by developing guidelines for the minimum competencies required to practice in the field.

Chemical Demilitarization

There are currently 70 million pounds of lethal chemical warfare material stored at eight locations in the continental United States and on one island in the Pacific Ocean. The Department of Defense (DOD) has been charged with

disposing of these materials, and EEHS's Chemical Demilitarization Branch is responsible for reviewing the technical and medical aspects of the disposal to ensure that the public is protected from possible exposure to these deadly chemicals. Thus far, working with Utah officials, the Environmental Protection Agency, and the Federal Emergency Management Agency, we have provided public health and safety oversight for the safe destruction, via incineration, of 8 million pounds of lethal chemical warfare agents at the first operational demilitarization site in Tooele, Utah. During 1998, we also convened a meeting of 30 state health and environmental personnel from the eight states where these agents are stored.

During 1999, we will work with the National Institute of Occupational Safety and Health to develop better monitoring equipment for use in detecting even minuscule releases of chemical agents. We will also be working with DOD to address the concerns of advocacy groups by considering the use of methods other than incineration for the destruction of chemical weapons and agents.

Vessel Sanitation

Because of several major disease outbreaks on cruise vessels, CDC established the Vessel Sanitation Program (VSP) in 1975 as a cooperative activity with the cruise ship industry. The VSP helps the cruise ship industry develop and implement comprehensive sanitation programs to minimize the risk for gastrointestinal illness. In addition, every vessel that has a foreign itinerary and that carries 13 or more passengers is subject to twice-yearly inspections and, when necessary, to reinspections by the VSP staff. Vessel owners pay a fee, based on tonnage, for all inspections. Approximately 130 cruise ships routinely participate in the program. We will also review plans for ship renovations and for the construction of new ships; at the request of a ship's owner (and at the owner's expense), we will conduct construction inspections when a ship is near completion and when it first enters a U.S. port.

During FY 1998, we conducted 210 inspections on 117 cruise vessels. Twenty-four ships (21%) failed inspection once, and four ships failed inspection more than once. We also investigated seven outbreaks of gastroenteritis aboard cruise ships, conducted four public health seminars for more than 400 industry personnel, and conducted several construction inspections.

In addition to providing the services described above, during FY 1999, we will help Australian public health officials with vessel sanitation activities in preparation for the 2000 Olympics in Sydney and finalize the revised *VSP Operations Manual*.

These are just some of the highlights of the division's activities. During the next year, we will continue to provide leadership in coordinating, delivering, and evaluating emergency and environmental health services, as well as concentrate on linking resources within NCEH and throughout CDC to meet this mandate.

Pharmaceutical Stockpile Management

To respond effectively to a terrorist release of chemical or biological agents, emergency workers will need rapid access to sufficient quantities of pharmaceutical antidotes, antibiotics, and vaccines that will not be readily available unless special stockpiles are created. Because local governments do not have the resources to create sufficient stockpiles on their own, NCEH has been given the mission to create and maintain special stockpiles of pharmaceutical supplies and equipment as a national resource to protect the civilian population in the event of a terrorist attack.

National Park Service Program

NCEH helps protect the health of people visiting national park facilities by conducting environmental health assessments of parks' potable water, waste-water treatment systems, and food-service facilities.

For further information, contact Dr. Henry Falk, Acting Director, Division of Emergency and Environmental Health Services, National Center for Environmental Health, CDC, Mail Stop F28, 4770 Buford Highway, NE, Atlanta, GA 30341-03724, or visit the NCEH Web site (www.cdc.gov/nceh).

Division of Environmental Hazards and Health Effects

The Division of Environmental Hazards and Health Effects (EHHE) addresses a broad mix of complex environmental health issues. EHHE deals with health problems associated with heavy metals; radiation exposure and other energy-related issues; and chemical toxicants such as marine toxins, pesticides, organochlorine compounds, endocrine disruptors, and solvents. EHHE also addresses health concerns associated with the physical environment, including air pollution and natural disasters, and directs a long-term national program designed to eliminate childhood lead poisoning. In addition, the division is increasingly playing a leading role in international efforts to prevent the health effects of environmental contamination and continues to develop and enhance partnerships with state and local health departments and with other interested parties. This overview will focus on three important priority areas for division activities: emerging environmental health threats, the public health response to asthma, and international environmental health.

Emerging Environmental Health Threats

Pfiesteria piscicida. *Pfiesteria* is a toxic dinoflagellate that has been found in estuarine waters along the southeastern coast. The organism is suspected of producing at least two toxins that may affect human health. In FY 1998, CDC received funding from Congress to investigate the possible human health effects associated with *Pfiesteria*. Thus far, we have established a six-state surveillance system and initiated a multistate cohort study of people whose work brings them into regular contact with contaminated water. The toxins produced by the organism have not yet been identified or isolated, so an exposure biomarker cannot be developed. The possible human health symptoms are vague, and the syndrome suspected of being caused by *Pfiesteria* has not been characterized.

Concentrated animal feeding operations (CAFOs). CAFOs are a growing trend in the agricultural industry. These operations concentrate thousands of animals in small areas to increase efficiency and improve yield. State health departments, along with consumer groups, public interest groups, and the media, have expressed concern that these CAFOs will adversely affect, not only the safety of the food supply, but also

the local groundwater, surface water, and air. There is some evidence that CAFOs may increase levels of nitrate and phosphorous in surface water near the facilities. We have just completed environmental sampling of a number of these operations in Iowa and Ohio and will determine our next steps on the basis of our analysis of the results.

Endocrine disruptors. Endocrine disruptors are compounds that may have properties that interfere with endocrine function. Although most of the findings of abnormalities have been in wildlife, including abnormal genitalia in polar bears, reduced penis size in alligators, and hermaphroditic genitalia in fish, there is concern that humans are also being affected. In November 1998, NCEH held a workshop of experts in the field to discuss the feasibility of conducting epidemiologic studies to investigate the effects of these compounds on humans. The report from that workshop is due in the spring of 1999. NCEH researchers are currently conducting approximately 15 different investigations of human exposure to compounds suspected of having endocrine-disrupting properties.

Pesticides. Over the next 2 years, EPA will re-register all commonly used pesticides under the Food Quality Protection Act. For many of these products, the human health effects are unknown, and the populations most likely to be exposed have not been identified. NCEH must be prepared to respond to requests from EPA and state health departments for epidemiologic and laboratory assistance in studies to determine the levels of human exposure and possible health effects.

A Public Health Response to Asthma

Asthma is one of the most common and costly diseases in the United States. In contrast to most other chronic diseases affecting children, the health burden of asthma is increasing. The estimated number of asthma sufferers increased from 6.7 million in 1980 to 14.6 million in 1995. Currently, an estimated 4.8 million children (7% of children under 18) suffer from asthma. More than 5,000 people died from asthma in 1995, and asthma accounts for nearly 500,000 hospitalizations per year. In addition, the burden of asthma falls disproportionately on black and Hispanic populations and appears to be particularly severe in urban inner cities. Following is a description of some of the steps that we are taking to combat this growing public health threat.

Establishing a network of asthma contacts. EHHE has established a network of asthma contacts in every state and in several metropolitan areas and U.S. territories. These contacts will act as focal points for asthma-related activities in their communities. During 1998, we provided these contacts with information related to asthma epidemiology, management, surveillance, and education, as well as on current asthma research. In February 1999, we will host the first asthma conference for these contacts and other partners in the field of asthma control and prevention.

Conducting surveillance. In collaboration with EPA and the National Instututes of Health (NIH), we have funded efforts by four state and two city health departments (in Arizona, California, Michigan, Wisconsin, Chicago, and New York City) to develop local models for surveillance that other health departments could replicate. In April 1998, we published a surveillance summary (*Surveillance for Asthma - United States, 1960-1995*), which showed that the number of self-reported asthma cases increased 75% between 1980 and 1994, that the death rate increased from 11.5 per 1,000,000 in 1979 to 17.9 in 1995, and that there were large differences in hospitalization rates between regions of the United States.

Providing education. People with asthma can lead highly productive lives once they learn how to control their asthma. In 1998, we funded an asthma education project in Wisconsin, which targeted people with asthma who were from families participating in Wisconsin's Welfare-to-Work program. The purpose of the project is twofold: (1) to provide people with asthma with the necessary techniques to manage their asthma so that they can complete their job training and remain in the job market, and (2) to teach day-care workers to care for children with asthma so that their parents can remain in training or on the job. We also developed and distributed an asthma speakers kit that can be used to educate asthma medical providers, school personnel, child care-givers, and others about asthma management.

Establishing partnerships. To foster community involvement in decision making and research, we have assisted states in developing public-private coalitions. All of the intervention projects that we have funded have been partnerships with local managed care organizations, nonprofit organizations, and community coalitions. The most extensive of these partnerships is ZAP Asthma, an innovative community-based approach in an area of Atlanta

with high asthma rates; ZAP Asthma gives community members the technical support they need to teach their neighbors how to avoid contact with things in their home that trigger asthma. Nationally, we actively work with EPA; NIH; ATSDR; the American Lung Association; the American Academy of Allergy and Asthma; the American College of Allergy, Asthma, and Immunology; and others.

Conducting applied research. In addition to the ZAP Asthma project, we are also participating in intervention studies in Wisconsin and California to demonstrate that comprehensive interventions can reduce the burden of asthma in the target audience. The Wisconsin study focuses on reducing indoor allergens to control asthma. The California study focuses on reducing exposure to environmental tobacco smoke.

International Environmental Health

A full overview of NCEH's global health activities is presented in the section on global health. EHHE has played a key role in these activities by helping public health professionals from other nations deal with a wide range of environmental problems. For example, we helped to conduct investigations of mysterious disease outbreaks in Cuba, Spain, and Haiti; to assess diarrhea incidence and water quality in Uzbekistan and other former Soviet republics; and to describe the association between asthma incidence and air pollution levels in Latin America. We have recently been particularly active in helping to prevent childhood lead poisoning throughout the world.

One of the great environmental health success stories has been the reduction of blood lead levels (BLLs) among U.S. children over the last two decades. During the late 1970s, 88.2% of children were estimated to have BLLs at or above 10 μg/dL. With the elimination of lead from gasoline and other public health measures, that percentage had fallen to 4.4% by the early 1990s. However, this U.S. success has not been universal, and many of the world's children are still exposed to unacceptably high levels of lead from a variety of sources.

Along with scientists from the NCEH laboratory, we have conducted investigations of childhood lead poisoning throughout the world. During 1998, for example, we helped survey BLLs among more than 1,700 kindergarten children in four Russian cities and among more than 1,000 Mexican children living in communities along the U.S.-Mexico border. During epidemiologic investigations in Egypt, conducted in collaboration with CDC's Field Epidemiologic Training Program, we found that elevated BLLs in residents of certain villages were caused by lead introduced into wheat by the local wheat-grinding process. As a result of this finding, Egyptian health officials are taking steps to

eliminate this source of lead exposure, and investigations of wheat grinding as a source of elevated BLLs are now being conducted in other areas of the Middle East, including Israel and Jordan. We are also planning to conduct surveys and investigations related to childhood lead poisoning in Peru, India, Brazil, and China. Our overall goal in all of these lead investigations is to reduce childhood lead levels by eliminating potential sources of exposure, such as gasoline, paint, and mining and smelting waste.

The Division of Environmental Hazards and Health Effects is responsible for addressing a myriad of environmental health problems, some of which have been problems for centuries (lead) and others which are just now emerging (*Pfiesteria* and endocrine disruptors). The division has developed a plan to deal with these issues and to respond to new, unforseen challenges over the next 5 years. With its skilled and motivated staff, EHHE will help NCEH and CDC lead environmental public health efforts on both the domestic and international fronts.

For further information, contact Dr. Henry Falk, Director, Division of Environmental Hazards and Health Effects, National Center for Environmental Health, CDC, Mail Stop F28, 4770 Buford Highway, NE, Atlanta, GA 30341-03724, or visit the NCEH Web site (www.cdc.gov/nceh).

Division of Laboratory Sciences*

During 1998, NCEH's Division of Laboratory Sciences (referred to here as "the Laboratory") significantly improved its ability to respond to toxic emergencies and chemical terrorism and to help prevent cancer, birth defects, heart disease, respiratory disease, and other health problems. The Laboratory continued to emphasize and develop biomonitoring (i.e., the direct measurement of a toxic substance in blood or urine to assess human exposure), which provides much better assessments of individual exposure than environmental monitoring. These more accurate assessments lead to better medical management of emergencies and help improve public health efforts to prevent disease and death caused by exposure to toxic substances. During the year, the laboratory collaborated in more than 40 health studies and investigations in which biomonitoring measurements were used to assess who had been exposed, what their levels of exposure were, and what levels of exposure cause disease or death. Highlights of the Laboratory's accomplishments follow.

**Proposed name*

Chemical Terrorism and Emergencies

The Rapid Toxic Screen. To support the public health response to a chemical terrorism incident, the Laboratory began work on developing the Rapid Toxic Screen, which will eventually have the capacity to rapidly analyze 150 chemical agents in human blood and urine samples to determine what chemical agents have been used, who has been exposed, and how much exposure each person has had. This exposure information is critically needed for the medical management of people affected or possibly affected by a chemical terrorist incident. The Rapid Toxic Screen will test for nerve agents (like the sarin gas used in Tokyo), nitrogen mustards, lewisites, sulfur mustards, hydrogen cyanide, selected toxins, heavy metals, pesticides, volatile organic compounds, and other chemicals that cause significant human disease and death. The Laboratory will add about 50 chemical agents to the Rapid Toxic Screen by October 1999 and will be adding about 50 more each of the next 2 years.

Preventing Disease from Exposure to Toxic Substances

Danish breast cancer study. Collaborating with investigators from Denmark, the Laboratory investigated the relationship between exposure to organochlorine pesticides and PCBs and the development of breast cancer among Danish women. In a nested case-control study of 268 women with breast cancer, women in the upper quartile for exposure to the pesticide dieldrin were 2.05 times more likely to have breast cancer than those in the lowest quartile. Dieldrin has estrogenic properties that may account for this finding. During 1999, we plan to participate in additional studies of the correlation between breast cancer and exposure to estrogenic chemicals, including dieldrin.

Trihalomethanes. Trihalomethanes are volatile compounds that have been associated in some studies with birth defects and with bladder and colorectal cancer. These compounds, which are often found in drinking water, are primarily caused by the bromination or chlorination of water.

The most significant weakness of previous studies has been their methods of estimating human exposure. During 1998, the Laboratory developed a method to simultaneously measure all the trihalomethanes in blood. Our initial evaluation of the method showed that it had excellent sensitivity and precision and was able to track increases in trihalomethane levels in people whose only exposure was by putting their arm in normal drinking water. This method will be used in health studies to assess exposure and correlate exposure with disease. In addition, we expect to participate with states in several studies that assess exposure to trihalomethanes in their populations.

Methyl eugenol. In mid-1998, the National Institute of Environmental Health Sciences notified the Laboratory that results of animal tests showed that a new compound, methyl eugenol, was a potent animal carcinogen. Within 5 months, the Laboratory developed a method to measure methyl eugenol in urine and determined a reference range for its concentration in people living in the United States. This new method to assess exposure to methyl eugenol and the human exposure data gathered thus far will be essential for planning studies to examine the human cancer risk associated with exposure to this newly recognized animal carcinogen.

Phytoestrogens. As noted above, considerable concern has developed over the ability of some chemicals to affect

the female body in the same manner as estrogen. Unfortunately, scientists have limited information about what chemicals have this property and even less information on the extent to which women are exposed to these chemicals. To help provide some of this missing information, the Laboratory developed new biomonitoring methods for a class of these compounds called phytoestrogens. In the next few years, we will be collaborating with investigators to evaluate the health impact of exposure to phytoestrogens and similar estrogen-like chemicals.

Mercury. Mercury is a well-recognized toxicant, but rapidly determining what portion of mercury exposure comes from a person's diet and what portion comes from other sources has not been possible through the use of standard analytical methods. This year, the Laboratory developed a rapid blood and urine method to measure both total inorganic mercury and organic mercury; this method will allow researchers to separate dietary exposure from other sources of mercury exposure. The new method will be used in the Fourth National Health and Nutrition Examination Survey (NHANES IV) starting in 1999 and in health studies of mercury amalgams, mercury exposure from fish, and emergencies caused by mercury poisoning.

Environmental tobacco smoke and toxic substances in cigarettes. Cigarette tobacco contains a group of chemicals known as tobacco-specific nitrosamines, which include some potent carcinogens. During 1998, the Laboratory developed a gas chromatography/mass spectrometry method to measure tobacco-specific nitrosamines in cigarette tobacco. Preliminary studies have been completed on the levels of these compounds among full-flavor, light, and ultra-light cigarette products, across different brands and manufacturers, and in a single brand over time. In 1999, we will develop methods to measure these compounds in cigarette smoke to assess how much of the tobacco concentration actually is inhaled into the lung.

Better assessment of exposure to environmental tobacco smoke (ETS) is needed by researchers studying the relationship between ETS exposure and cancer, heart disease, sudden infant death, and respiratory and other diseases. To meet this need, the Laboratory developed a method to measure salivary cotinine (a major metabolite of nicotine) using high-performance liquid chromatography and tandem mass spectrometry. This salivary cotinine measurement can assess the amount of ETS to which a nonsmoker has been exposed for several days preceding the

test. The salivary cotinine measurement will be used in surveys to determine how much ETS exposure that children and adolescents have had; to determine what levels of ETS exposure cause disease; and to assess the effectiveness of interventions aimed at reducing ETS exposure among childbearing women, young children, adolescents, and adults. In addition, because the salivary cotinine method reliably assesses whether a person is a current smoker, it can also provide an objective measure of the effectiveness of smoking-cessation interventions.

When a cigarette burns, it produces polyaromatic hydrocarbons (PAHs) from a compound in the tobacco called solanesol. Many of these PAHs are carcinogens. This year, the laboratory developed a mass spectrometric method to measure solanesol in cigarette tobacco to better determine factors that affect the amount of carcinogens released in cigarette smoke. Solanesol measurements will be used in future studies of the amount of PAHs absorbed by people who smoke cigarettes and by those exposed to ETS.

Organochlorines and PCBs. During 1998, the Laboratory made a major breakthrough in the measurement of organochlorine pesticides and polychlorinated biphenyls (PCBs). Many of these compounds are known or suspected human carcinogens. By developing a new approach that simultaneously uses two high-resolution capillary columns in the gas chromatograph, the Laboratory's scientists were able to triple the speed of analysis without sacrificing sensitivity, accuracy, precision, or specificity. The new method, which is also more easily automated to run overnight, will be used in the upcoming year to support at least five major studies of pesticide and PCB exposures.

Improving the Diagnosis, Treatment, and Prevention of Selected Chronic Diseases

Homocysteine and methyl malonic acid. These two substances are under active investigation as risk factors for coronary heart disease and birth defects. During 1998, the Laboratory developed gas chromatography/mass spectrometry methods for measuring homocysteine and methyl malonic acid in serum. We also surveyed 15 other laboratories in the United States and abroad to identify factors that influence the accuracy and precision of these measurements and found that gas chromatography/mass spectrometry methods yielded the highest-quality results. Starting in 1999, the new homocysteine and methyl malonic acid methods will be used in NHANES IV to assess levels in the U.S. population.

The Neonatal Disease Reference Laboratory. This section of the Laboratory continued to help prevent pneumonia, mental retardation, and premature death by providing regular quality-assurance evaluations and technical assistance to state laboratories that screen for

neonatal diseases such as sickle cell disease, congenital hypothyroidism, phenylketonuria, galactosemia, homocystinuria, congenital adrenal hyperplasia, and biotinidase deficiency.

Methods for NHANES IV. In collaboration with the National Center for Health Statistics, we have served as the central laboratory for the NHANES surveys since 1971. During 1998, we developed or modified 50 analytical methods for NHANES IV and completed the pilot phase of that survey. Among the methods we developed is a special anti-oxidant battery of tests for retinol, alpha-tocopherol, gamma tocopherol, lutein, zeaxanthin, beta-cryptoxanthin, lycopene, alpha carotene, beta carotene, and retinyl esters, and other substances. NHANES IV, which will begin in 1999, will provide health data about a national representative sample of the U.S. population.

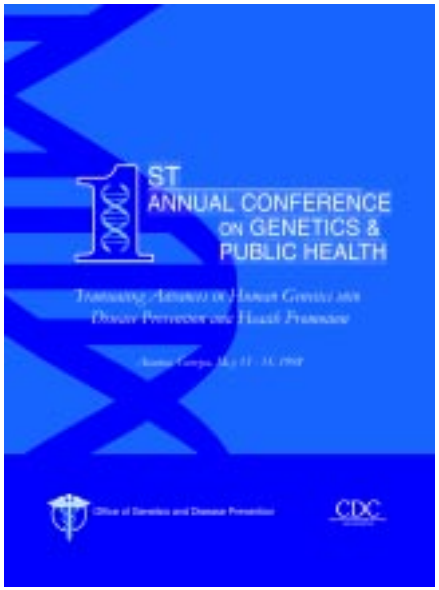
The Cardiovascular Disease Reference Laboratory. This section of the Laboratory continued to standardize the measurement of cholesterol and related lipids in more than 140 laboratories across the world. During 1998, more than 100 major clinical studies of risk factors for heart disease were based on accuracy measurements performed by this laboratory. Approximately 85% of cholesterol measurements performed in the United States as part of patient care were traceable to the accuracy base of the Cardiovascular Disease Reference Laboratory.

For further information, contact Dr. Eric Sampson, Director, Division of Laboratory Sciences, National Center for Environmental Health, CDC, Mail Stop F20, 4770 Buford Highway, NE, Atlanta, GA 30341-03724, or visit the NCEH Web site (www.cdc.gov/nceh).

Office of Genetics and Disease Prevention

Background

The past year has been an exciting period in human genetics. Almost daily, newspapers reported new discoveries, and new genetic tests continued to be developed and marketed. In addition, it was announced that the Human Genome Project—an international effort to map and sequence the entire human genome—will be finished in 2003, two years ahead of schedule. While such news is exciting, a tremendous gap still exists between advances in human genetics and the practical application of those advances in disease prevention and health promotion. During 1998, CDC's Office of Genetics and Disease Prevention (OGDP) worked to close that gap by mobilizing leaders in public health to begin the process of translating advances in genetics into opportunities for disease prevention.



Highlights from 1998

One of our key accomplishments in 1998 was to coordinate the "First Annual Conference on Genetics and Public Health" in Atlanta, Georgia, in May 1998. The conference was sponsored by CDC, the Health Resources and Services Administration (HRSA), the National Human Genome Research Institute (NHGRI), and the Association of State and Territorial Health Officials (ASTHO) and affiliates. The main purpose of the conference was to educate participants about the process for integrating advances in human genetics into public health programs and to strengthen partnerships between genetics researchers and public health organizations for disease prevention and health promotion efforts. Nearly 400 people from federal, state, academic, consumer, community, and industry organizations attended the conference; 41 states and U.S. territories were represented.

Another of our key activities in 1998 was working with the Council of State and Territorial Epidemiologists, HRSA, ASTHO, and affiliates on a state survey to assess the status of state-based public health efforts related to genetics and to evaluate key issues and concerns regarding the impact of recent advances in genetic knowledge on public health activities.

We were also committed to building and enhancing genetics capacity through training and education activities, including a 2-day introductory course in genetics and disease prevention. We conducted the course for public health professionals twice in 1998 and are planning to offer it via distance-based learning programs in the future. In addition, we collaborated with the CDC Office of the Associate Director for Science and the National Human Genome Research Institute in sponsoring a monthly, CDC-wide, distinguished speaker series on ethical, legal, and social issues in genetics and public health.

Priorities for 1999

The following are OGDP's four priorities for 1999.

1. Promote national public health leadership in genetics and disease prevention. This will include sponsoring the Second Annual Conference on Genetics and Disease Prevention and continuing to strengthen partnerships with national and state organizations.

2. Continue to promote the integration of genetics into disease prevention programs within and outside CDC. Activities in support of this priority will include working with other CDC centers on strategic planning and program development as well as supporting prevention research and topic-specific workshops.

3. Continue to develop a public health infrastructure in genetics. We will help build this infrastructure by developing courses, expanding the CDC-wide genetics career development program, and providing technical assistance to public health organizations.

4. Work to make information about genetics and disease prevention more available. Such information includes epidemiologic data on human genetic variation in relation to specific diseases and data about new genetic tests.

Through these and other activities, CDC's Office of Genetics and Disease Prevention will continue to help translate advances in human genetics into effective disease prevention and health promotion efforts.

For further information, contact Dr. Muin Khoury, Acting Director, Genetics and Disease Prevention Office, National Center for Environmental Health, CDC, Mail Stop K28, 4770 Buford Highway, NE, Atlanta, GA 30341-03724, or visit the NCEH Web site (www.cdc.gov/nceh).

FY 1998 Major Research Findings and Publications
National Center for Environmental Health

Asthma

- **Homa DM, Mannino DM. Asthma mortality in U.S. Hispanics and non-Hispanics, 1984-1995. Am J Respir Crit Care Med 1998;157:A11.** Findings of particular interest were that age-adjusted asthma mortality rates for Hispanics were three to nine times higher in the Northeast than in other U.S. regions. Both age-specific and age-adjusted mortality rates for Hispanics were greater than those for non-Hispanics in the Northeast, whereas Hispanics had lower rates than non-Hispanics in other regions. The elevated rates for Hispanics observed in the Northeast, where more Hispanics are of Puerto Rican origin than in other regions, suggested that asthma mortality may differ between the various Hispanic national groups, although other factors (e.g., socioeconomic status, access to medical care, and completeness of reporting) need to be assessed.
- **Ball LB, Mannino DM. Ambulatory asthma visits, United States, 1992-1995. Am J Respir Crit Care Med 1998;157(3):A50.** This study showed that rates of asthma ambulatory visits vary dramatically by region and race. The Northeast had the highest rates and the largest increases in rates of emergency room visits due to asthma. For outpatient and doctor office visits due to asthma, the Northeast had the highest rates, followed by the Midwest, South, and West in descending order. Blacks had higher rates of emergency room and outpatient visits than whites, but the rates of office visits by blacks and whites were similar. Further study is needed to determine if these differences are due to diagnostic practices, access to care, asthma prevalence, or other factors.
- **National Center for Environmental Health, Centers for Disease Control and Prevention. Surveillance for asthma—United States, 1960-1995. MMWR 1998;47(SS-1):1-27.** This study showed that asthma death rates and self-reported asthma prevalence rates increased during 1960-1995 both nationally and internationally. Asthma hospitalization rates increased in some regions and decreased in others. At the state level, where only death data were available for asthma, death rates varied substantially among states within the same region. This study also indicated that surveillance data are inadequate for fully assessing asthma trends at the state or local level. Implementation of better state and local surveillance can increase our understanding of asthma and contribute to more effective treatment and prevention strategies.

Birth Defects

- **National Center for Environmental Health, Centers for Disease Control and Prevention. Trends in infant mortality attributable to birth defects—United States, 1980-1995. MMWR 1998;47:773-8.** This study showed that the proportion of infant deaths due to birth defects increased from 1980 to 1995. There were differences in birth defect death rates by state (even when the analysis

was restricted by race), indicating that race is not the predominant reason for geographic differences in the rates. Four states have reduced their rates by almost half; therefore, it's important to understand factors that contributed to these reductions and the geographic differences in order to help reduce rates in other states.

- **Botto LD, Mastroiacovo P. Exploring gene-gene interactions in the etiology of neural tube defects. Clin Genet 1998;53:456-9.** The authors describe a "simple epidemiologic approach" to exploring gene-gene interactions and the application of the approach in re-evaluating data from a case-control study on the association of neural tube defects (NTDs) with specific mutations of the 5,10-methylene-tetrahydrofolate reductase (MTHFR) and cystathionine-ß synthase (CBS) genes. They found that homozygosity for the MTHFR mutation was associated with a two-fold increased risk for NTDs, whereas homozygosity for mutations at both loci was associated with a five-fold increased risk for NTDs. The results suggest that gene-gene interactions play a role in modulating susceptibility to NTDs in a proportion of affected individuals and that the epidemiologic approach used in this analysis could be a valuable adjunct to the study of these interactions in the etiology of human disease.
- **National Center for Environmental Health, Centers for Disease Control and Prevention. Use of folic acid-containing supplements among women of childbearing age—United States, 1997. MMWR 1998;47(7):131-4.** The B vitamin folic acid can reduce the occurrence of spina bifida and anencephaly by at least 50% when taken daily before conception and during early pregnancy. In 1992, the Public Health Service (PHS) recommended that all women of childbearing age who are capable of becoming pregnant consume 400 µg of folic acid daily. This report, which summarizes findings from a survey conducted during January and February 1997, indicates that only one-third of women of childbearing age consume a supplement containing the recommended amount of folic acid daily.

Cancer

- **Dorgan JF, Sowell A, Swanson CA, Potischman N, Miller R, Schussler N, Stephenson HE Jr. Relationships of serum carotenoids, retinol, alpha-tocopherol, and selenium with breast cancer risk: results from a prospective study in Columbia, Missouri (United States). Cancer Causes Control 1998;9:89-97.** Results suggest that the carotenoids ß-cryptoxanthin, lycopene, and lutein/zeaxanthin may protect against breast cancer. No protective effect was seen for α- and ß-carotene, α-tocopherol, retinol, or selenium.

Carbon Monoxide

- **National Center for Environmental Health, Centers for Disease Control and Prevention. Use of unvented residential heating appliances, US, 88-94. MMWR 1997;46(51):1221-4.** The authors analyzed data from CDC's NHANES III to describe U.S. adults who reported using unvented residential heating appliances or gas stoves or misusing ovens as heating devices between

1988 and 1994. Combustion by-products such as carbon monoxide can be life-threatening. The results indicate that unvented residential space heaters were used more commonly by adults in the South and rural areas and among those with low annual household incomes.

- **Yoon SS, Macdonald SC, Parrish RG. Deaths from unintentional carbon monoxide poisoning and potential for prevention with carbon monoxide detectors. JAMA 1998;279:685-7.** This study indicates that carbon monoxide detectors may have prevented half of the 136 deaths in residences studied. It also showed that a high proportion of decedents with alcohol in their blood indicates that effective public health campaigns should address the role of alcohol in carbon monoxide poisonings.

Cerebral Palsy

- **Schendel DE, Berg CJ, Yeargin-Allsopp M, Boyle CA, Decouflé P. Prenatal magnesium sulfate exposure and the risk for cerebral palsy or mental retardation among very low-birth-weight children aged 3 to 5 years. JAMA 1996;276:1805-10.** This study shows a 90% reduction in the rate of cerebral palsy and a 70% reduction in the rate of mental retardation among very low-birth-weight infants born to mothers who had been given intravenous magnesium sulfate than among those born to mothers who did not receive the drug. Magnesium sulfate is given to women who have preeclampsia or are in preterm labor. This paper won CDC's Charles G. Shepherd Science Award for 1997.

Cystic Fibrosis

- **Roberts HE, Cragan JD, Cono J, Khoury MJ, Weatherly MR, Moore CA. Increased frequency of cystic fibrosis among infants with jejunoileal atresia. Am J Med Genet 1998;78:446-9.** Results indicate that white infants with jejunoileal atresia (JIA) are at 210 times greater risk for cystic fibrosis (CF) than white infants in the general population. This association is biologically plausible and is a consequence of meconium ileus. These results have implications for management of infants born with JIA and genetic counseling for families with affected infants. CF should already be part of the differential diagnosis for any newborn presenting with meconium ileus, and all infants with JIA and meconium ileus should be tested for CF. If it is not known whether a deceased child who had JIA also had meconium ileus, the parents should be tested to determine whether they are CF carriers before being counseled on their risk of having another child with JIA.

Fetal Alcohol Syndrome

- **National Center for Environmental Health, Centers for Disease Control and Prevention. Alcohol consumption among pregnant and childbearing-aged women—United States, 1991 and 1995. MMWR 1997;46:346-50.** This study showed that the prevalence of frequent drinking during pregnancy is increasing. The proportion of pregnant women drinking at least seven drinks per week or at least five drinks on any occasion during the previous month increased from 0.8% in 1991 to 3.5% in 1995.

Hearing Loss

- **Niskar AS, Kieszak SM, Holmes A, Esteban E, Rubin C, Brody DJ. Prevalence of hearing loss among children 6 to 19 years of age. JAMA 1998;279:1071-5.** This analysis indicates that 14.9% of U.S. children have low- or high-frequency hearing loss of at least 16-dB hearing level in one or both ears. Because children's ability to hear influences development of communication and behavioral skills, audiometric screening of children in elementary, middle, and high school should include low- and high-frequency testing to detect hearing loss so that negative outcomes can be prevented.

- **National Center for Environmental Health, Centers for Disease Control and Prevention. Serious hearing impairment among children Aged 3-10 years—Atlanta, Georgia, 1991-1993. MMWR November 14, 1997; 46(45);1073-6.** This study showed that a substantial proportion of children born with serious bilateral hearing impairment in Atlanta during 1981-1990 were not diagnosed at a sufficiently early age to benefit fully from intervention services to minimize delays in the acquisition of speech and language skills and, possibly, reduce the occurrence of other disabilities associated with hearing impairments. The findings emphasize the public health opportunity offered by early identification of and intervention for children with hearing impairment and the need for developing and evaluating universal newborn hearing screening programs.

Hemochromatosis

- **Burke W, Thomson E, Khoury MJ, et al. Hereditary hemochromatosis: gene discovery and its implications for population-based screening. JAMA 1998;280(2): 172-8.** Hemochromatosis is a disorder of iron metabolism that results in excessive absorption of ingested iron into the body, which can lead to a number of life-threatening problems. The authors conclude that genetic testing is *not* recommended at this time in population-based screening for hereditary hemochromatosis because too much about the disease is not known (e.g., prevalence and penetrance of hemochromatosis gene [*HFE*] mutations and the optimal care of asymptomatic people carrying *HFE* mutations). Discrimination and stigmatization may also result from testing. More population-based research is needed to determine the prevalence of *HFE* mutations, the age- and sex-related penetrance of different *HFE* genotypes, interactions between HFE genotypes and environmental modifiers, and psychosocial outcomes of genetic screening for hemochromatosis.

Human Genome Epidemiology Network

- **Khoury MJ, Dorman JS. The Human Genome Epidemiology Network. Am J Epidemiol 1998; 148(1):1-3.** This editorial outlines the need and rationale for a population-based epidemiologic approach to the human genome and describes NCEH and partners' launch of a global collaboration, the Human Genome Epidemiology Network (HuGE Net). The goals of HuGE Net are to (1) establish an information-exchange network that promotes global collaboration in developing and

disseminating peer-reviewed epidemiologic information on human genes; (2) develop an updated and accessible knowledge base on the World Wide Web; and (3) promote the use of this knowledge base by health care providers, researchers, members of industry and the government, and the public for making decisions involving the use of genetic tests and services for disease prevention and health promotion.

Iodine Intake

- **Hollowell JG, Staehling NW, Hannon WH, et. al. Iodine nutrition in the United States. Trends and public health implications: iodine excretion data from National Health and Nutrition Examination Surveys I and III (1971-1974 and 1988-1994). J Clin Endocrinol Metab 1998;83:3401-8.** Iodine is necessary for adequate brain development and function. This study showed that iodine intake in the U.S. population has decreased more than 50% over the past 20 years and that 12% of Americans have low iodine levels. Iodine levels need to be closely monitored to make sure that they don't decrease to levels that could pose a future threat to public health in the United States.

Lead

- **National Center for Environmental Health, Centers for Disease Control and Prevention. Screening young children for lead poisoning: guidance for state and local public health officials. Atlanta: US Department of Health and Human Services;1997.** This new NCEH guidance is designed to assist state and local health officials in determining which children in their jurisdictions will benefit from screening.

Lung Function

- **Mannino DM. Obstructive lung diseases and low lung function in the United States population, 1988-94: results from NHANES III. Am J Epidemiol 1998; 147(11):S14.** Of those studied, 75% with documented low lung function had no prior diagnosis of any obstructive lung disease, such as chronic bronchitis, emphysema, and asthma. These results suggest that many U.S. adults have undiagnosed lung disease that could be easily discovered with pulmonary function testing.

Mental Retardation

- **Murphy CC, Boyle C, Schendel D, Decouflé P, Yeargin-Allsopp M. Epidemiology of mental retardation in children. Ment Retard Develop Disabil Res Rev 1998;4:6-13.** This article reviews well-known causes of mental retardation and epidemiologically established risk factors. It concludes that since mental retardation is a heterogeneous group of disorders with various causes, investigators need to continue refining research methods to define homogeneous groups so that causes can be identified. Identification of genetic factors and their causal link to mental retardation is important. Areas of research that will be particularly challenging are (1) the relationship between socioeconomic factors and other risk factors for mental retardation; and (2) the extent to which the variation in mental retardation prevalence is

due to differences in quality of intervening care and the postnatal environment.

Polycyclic Aromatic Hydrocarbons

- **Smith CJ, Grainger J, Patterson DG Jr. Separation of polycyclic aromatic hydrocarbon metabolites by gamma-cyclodextrin-modified micellar electrokinetic chromatography with laser-induced fluorescence detection. J Chromatogr A 1998;803:241-7.** Polycyclic aromatic hydrocarbons (PAHs) are classified as potential carcinogens, and human exposure is universal. Metabolic products of PAHs can be important markers for exposure and future health risks. This study describes the development and use of a new way to separate these metabolic products.

Sex Ratio

- **Marcus M, Kiely J, Xu F, McGeehin M, Jackson R, Sinks T. Changing sex ratio in the United States, 1969-1995. Fertil Steril 1998;70:270-3.** Results showed that the sex ratio (number of male births/number of female births) declined significantly among whites, but increased significantly among blacks. Possible explanations are random fluctuations in sex ratio over time, changes in population demographic characteristics, and changes in intercourse frequency or timing. Environmental exposures are unlikely to account for the observed trends.

Surveillance

- **National Center for Environmental Health, Centers for Disease Control and Prevention. Monitoring environmental disease—United States, 1997. MMWR 1998;47(25):522-5.** This report assesses the progress that environmental health monitoring programs in the 50 states, the District of Columbia, and Puerto Rico have made toward achieving the Healthy People 2000 (HP2000) objective to establish and monitor nonoccupational, sentinel environmental diseases. At the time of publication, childhood lead poisoning was the only environmental condition for which an HP2000 objective had been met. This document provides the programs with a means of comparing their progress toward achieving HP2000 objectives.

- **National Medicolegal Review Panel. National guidelines for death investigation. Washington, DC: US Department of Justice; 1998.** This publication, a collaboration of NCEH and the National Institute of Justice, can be used to improve the quality and completeness of medicolegal death investigations. The guidelines are available in hard copy and at http://ncjrs.org/pdffiles/167568.pdf on the Internet.

Tobacco

- **Mannino DM. Health effects of environmental tobacco smoke exposure among children in the US: results from NHANES III. Epidemiol 1998 9(4):S97.** Results indicate that children with reported exposure to environmental tobacco smoke (ETS) had more wheezing

and asthma (past and current) but not more sinusitis than those with no exposure. Children with a higher (> 0.8 nanograms/milliliter) cotinine level (a measure of ETS exposure) reported more wheezing, asthma (past and current), and sinusitis than those with lower levels. These results indicate that ETS exposure is associated with preventable acute and chronic respiratory health effects among children.

- **Song S, Ashley DL. Sample purification for the analysis of caffeine in tobacco by gas chromatography-mass spectrometry. J Chromatogr A 1998;814:171-180.** Tobacco product manufacturers sometimes add cocoa, which contains caffeine, to tobacco. The added caffeine can make it more difficult to quit smoking. This paper describes a sensitive and selective gas chromatography-mass spectrometry method developed to measure caffeine in tobacco. Caffeine levels in the commercial tobacco products tested ranged from below the detection limit to 125 micrograms/gram. The sample preparation and analysis protocol described should be applicable to measuring related compounds in tobacco products and to the analysis of other complicated systems.

Vessel Sanitation

- **National Center for Environmental Health. Final recommendations to minimize transmission of Legionnaires' disease from whirlpool spas on cruise ships. Atlanta: Centers for Disease Control and Prevention; 1997.**
- **National Center for Environmental Health. Final recommended shipbuilding construction guidelines for cruise vessels destined to call on U.S. ports. Atlanta: Centers for Disease Control and Prevention; 1997.**

List of Abbreviations

ASTHO	Association of State and Territorial Health Officials
ATSDR	Agency for Toxic Substances and Disease Registry
BLL	blood lead level
BRFSS	Behavioral Risk Factor Surveillance System
CAFO	concentrated animal feeding operation
CDC	Centers for Disease Control and Prevention
CF	cystic fibrosis
CIOs	centers, institutes, and offices (at CDC)
DCDDH	Division of Child Development, Disability, and Health, NCEH
DOD	Department of Defense
EEHS	Division of Emergency and Environmental Health Services, NCEH
EHHE	Division of Environmental Hazards and Health Effects, NCEH
EPA	Environmental Protection Agency
EPRB	Emergency Preparedness and Response Branch, EEHE
ETS	environmental tobacco smoke
FAS	fetal alcohol syndrome
FY	fiscal year
HP 2000	Healthy People 2000
HRSA	Health Resources and Services Administration
HuGE Net	Human Genome Epidemiology Network
ICIDH-2	*International Classification of Impairments, Disabilities, and Handicaps* (revised)
JIA	jejunoileal atresia
MADDSP	Metropolitan Atlanta Developmental Disabilities Surveillance Program
MM	micronutrient malnutrition
MMWR	Morbidity and Mortality Weekly Report
NCEH	National Center for Environmental Health, CDC
NCFA	National Council on Folic Acid
NCID	National Center for Infectious Diseases, CDC
NHANES	National Health and Nutrition Examination Survey
NHGRI	National Human Genome Research Institute
NTD	neural tube defect
OGDP	Office of Genetics and Disease Prevention, CDC
PAH	polyaromatic hydrocarbon
PCB	polychlorinated biphenyl
PHS	Public Health Service
UN	United Nations
VSP	Vessel Sanitation Program

For more information about

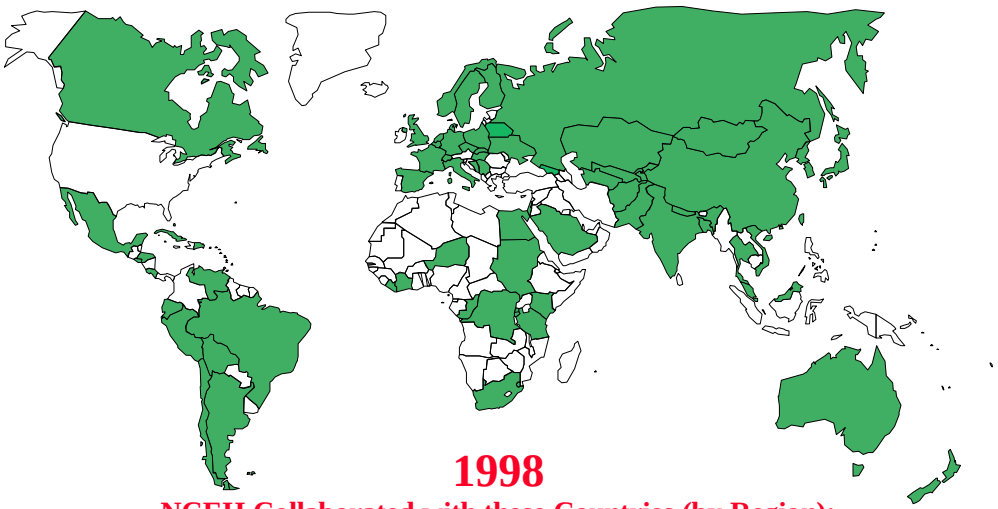
the programs and activities at the

National Center for Environmental Health (NCEH)

visit our Internet Web site:

http://www.cdc.gov/nceh

e-mail: NCEHinfo@cdc.gov



1998

NCEH Collaborated with these Countries (by Region):

Established Market Economies		Latin America/Caribbean		Former Socialist Economies	Middle Eastern Crescent	Sub-Saharan Africa		Other Asia /Pacific Islands	
Australia	Japan	Argentina	Ecuador	Belarus	Afghanistan	Burundi	Rwanda	Bangladesh	Nepal
Belgium	Netherlands	Bahamas	El Salvador	Bosnia	Egypt	Congo	S. Africa	Brunei	N. Korea
Canada	New Zealand	Bolivia	Honduras	Czech. Rep.	Israel (and Gaza)	Cote d'Ivoire	Sudan	China (and Taiwan)	Pakistan
Denmark	Norway	Brazil	Mexico	Poland	Kazakhstan	Dem. Rep. Congo	Swaziland	India	Singapore
Finland	Spain	Chile	Peru	Rep. Georgia	Kyrgystan	Kenya	Tanzania	Korea	Taiwan
France	Sweden	Costa Rica	Trinidad	Russia	Saudi Arabia	Liberia		Malaysia	Thailand
Germany	Switzerland	Cuba	Venezuela	Slovakia	Tajikistan	Niger		Mongolia	Vietnam
Hungary	UK	Dominican Rep.		Ukraine	Turkmenistan				
Italy				Yugoslavia	Uzbekistan				